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Tool and Manufacturing Engineers Handbook

THIRD EDITION

A Reference Work for Manufacturing Engineers

*Revised under the Supervision of
The SME Publications Committee
with the Assistance of
The SME Technical Division*

DANIEL B. DALLAS
Editor-in-Chief



SOCIETY OF MANUFACTURING ENGINEERS
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19-78
COLD-ROLLING PROCESSES - SHEET AND COIL STOCK

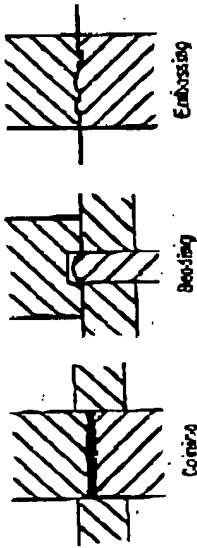
or hardness of urethane. Since a softer grade will deflect under pressure before a harder grade, it is possible to govern the time during the stroke when a certain disk will begin to deflect, and also to some extent, the degree of deflection.

Accuracy in bulging is limited only by the accuracy of the cavity in the rammer die, as can be seen from the following table.

Metals up to $\frac{1}{8}$ in. thick have been successfully bulged by this process. Expansion in one operation may be as much as 50 percent of the blank diameter for the more ductile metals such as copper, aluminum, soft brass, silver, and low-carbon steels.

Compression Coatings

Coining, swaging, and ring are metal-compression processes used to impart a pattern, configuration, or decoration on parts produced from flat-rolled material. Figure 15-86 illus-



EW 15.86 Compression of coloring, beading, and embossing operations. (L. W. Bliss Co.)

trates the differences between crining, beading, and embossing operations. Sizing and swag-

ing are closely related to grinding.

Coring Coring is the most severe of the metal-squeezing operations in the amount of pressure applied to each square inch of material. In this process, the metal thickness is changed, as is the internal structure of the workpiece. Because a closed die is generally used to confine the metal, the workpiece will be an accurate reproduction of the die cavity. *Coring is a metal-squeezing operation and will therefore*

Theoretically metals are not compressible, but many metals are viscous and will undergo flow under pressure. The highest pressure in a given squeezing operation is required to set the part at the very bottom of the press stroke. As movement progresses, the fluidity of the metal decreases and the pressure to sustain the movement must be increased. Both lateral and vertical movements can be achieved, and many parts that require nonuniform metal thickness and nonuniformly manufactured only by forming.

The coining process is used to manufacture medallions, jewelry, metal buttons, and coins. The process is the most practical for producing smooth surfaces that also include details of all types. The process is the most practical for producing smooth surfaces that also include details of all types. The process is the most practical for producing smooth surfaces that also include details of all types.

Coining Pressure. Accurately determining the pressure required for a coining operation is a design difficulty. The factors determining pressure are (1) the area to be squeezed, (2) the resistance created within the metal (compressive strength), (3) the freedom of flow, and (4) the work hardenability of the metal. Some known allowable pressures for coining operations may be found below, see strength in *Fig. 15-47*.

Unit pressures on materials during coining range from three to five times the compressive strength of the material. If the required pressure must be determined exactly, laboratory tests should be conducted using either a hydraulic press or a mechanical press equipped with a strain gage. A mechanical press of the knuckle-joint type is preferred for both testing and manufacturing coined objects. The knuckle-joint press provides a slow squeeze and dwell at the bottom of its stroke. It is recommended that the pressure obtained on tests in a hydraulic press be increased a minimum of 100 percent when a mechanical press is to be used for manufacturing of the part that was tested.

production of the part that was tested. When a press is to be selected for making production, consideration must be given to possible variations in thickness and properties of the metal to be formed. Also, in view of the accuracy of the part to be produced and the concentrated load that occurs, a liberal safety factor should be allowed over the theoretical load. A press operating at 50 percent of its capacity will produce better parts and run with less downtime than if it is subjected to maximum capacity to produce the same part. A small bed area with the ability to take a concentrated load with minimum deflection is desirable. Drop hammers are often used in the construction of tableware.

brass, bronze, and copper.
accuracy, polished surfaces,
fracture during coining.

fracture during counting.

NO ADVANTAGES OF PARTS PRODUCED BY COUNTING ARE UNDERSTOOD

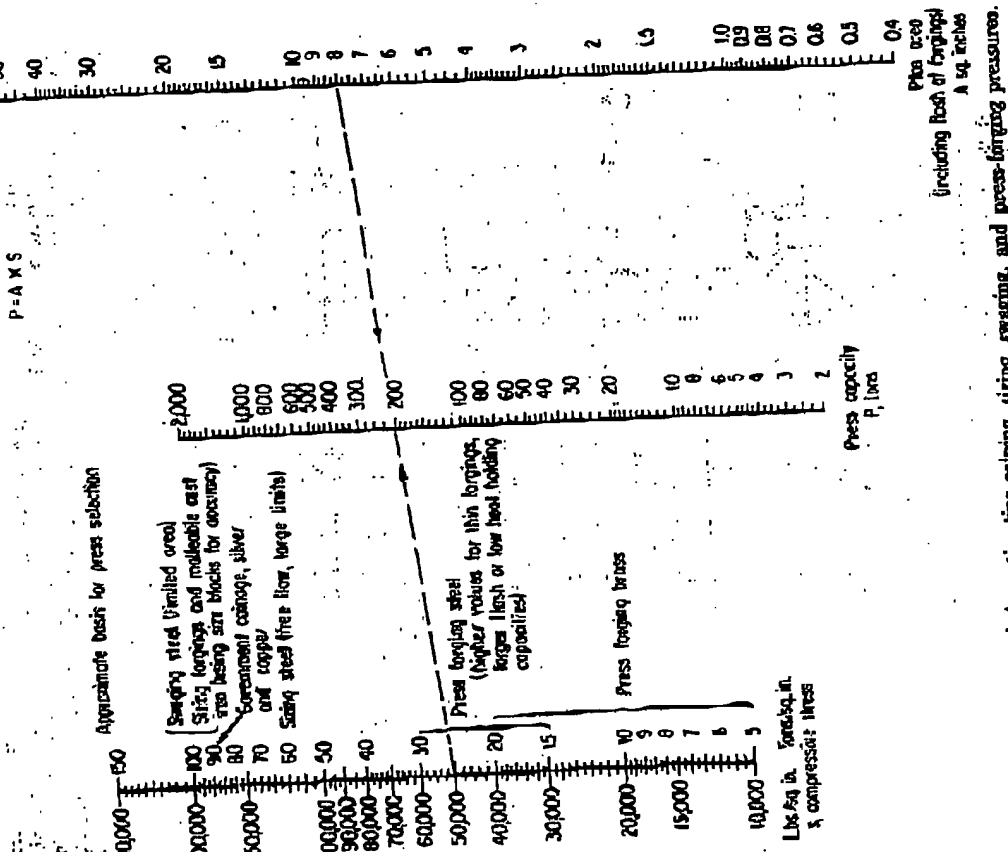


Fig. 15-37 Nomograph for estimating cutting, sizing, swaging, and drawing of W. H. & Co.)

increased strength, and economy both in material and manufacturing. The limitations of coining processes are that the steels must be used that can withstand the high unit pressures generated and that metal movement of the components must be held to a minimum. Sizing operations are closely related to coining in that this process, like coining, is a cold-chamber operation. The limitations of sizing are that the components must be of a uniform cross section and that the tolerances must be held to a minimum.

Most ring operations are performed in open dies; so the entire workpiece is not confined